Walking Leaf Specs (M-LFTR-VI)

Micro Liquid Fluoride Thorium Reactor - Sixth Generation

General Specifications

Operation Pressure: One atmosphere (14.7 psi) at sea level

Power Generation: 15 MWth (thermo), 10 MWe (electrical). Enough electrical energy to power approximately 10,000 average-sized residences in the Midwest United States. The efficiency is 70 percent, a 100 + percent improvement over PWRs and BWRs (current large nuclear power plants). Fuel is melted into a stable fluoride molten mix and also serves as the coolant.

Core Temperature at Critical: 900 degrees C. (1,652 degrees F)

Alloy Sartorium (St-64): Extremely light. Can be 3-D printed or formed in casting. It will not corrode, and its properties can be adapted for the end user during fabrication, eliminating the need to mine other rare earth minerals. In addition to nuclear energy, aerospace, medicine, transportation, and maritime applications, it is also used as rust-free rebar in advanced cements.

***Walking Leaf* Uranium 3-D Print Fabrication (HALEU)**: High Assay Low Enriched Uranium (20-percent enriched). Prints nickel alloy and uranium metal. Segregates neutron-absorbing isotopes for greater fuel efficiency. Enriches the fuel as it is printed. This advancement allows for the reactor to be highly fuel-efficient and very small. The solid fuel is then melted in a stable fluoride mix. The second loop can be a variety of molten metals or helium gas for transferring heat from the core of the reactor to the

Delivery and Pickup: All *Walking Leaf* reactors will be delivered to their end users, fully fueled and tamper-proof. When picked up or serviced, *Walking Leaf* personnel will replace the entire reactor.

Primary Start-up Fuel Strategy: *Walking Leaf* HALEU will be provided to *Walking Leaf* operators in participating countries, with the International Atomic Energy Agency (IAEA) serving as the safety and anti-proliferation enforcement body. For countries providing their own input of HALEU, plutonium, or U-233, the fuel will be either:

- Contaminated with U-232 to prevent proliferation or,
- In the case that a member country wishes to utilize a highly enriched uranium (HEU) as starter fuel, the *Walking Leaf* Reactor must be located at an IAEA-supervised facility, most likely the same location where the HEU fuel is down blended.

Secondary Start-up Fuel Strategy: Once a critical mass of *Walking Leaf* reactors is in operation, some of those reactors will be designated to produce U-233 for starter fuel for future *Walking Leaf* reactors. That fuel will be proliferation-proof, and the fuel loop can be closed. Ongoing mining of thorium will be required but is abundant around the world and easy to access with a small ecological footprint.

TOP SECRET: Unauthorized *Walking Leaf* reactors being secretly built in totalitarian nation-states or despot-controlled regimes are regulated by the International Nuclear Intelligence Peace Alliance (INIPA) in coordination with the International Underground Nuclear Energy Scientific Consortium (IUNESC). These organizations were formed with the realization that nuclear power technology had evolved in simplicity, price, and operation that even small organizations with modest resources and limited scientific means could now build a nuclear reactor. INIPA and IUNESC manage first contact protocols, Blockchain Encryption Protocols (BEP) for communication, and the supply chain for all materials and nuclear fuel. Known as the White Market, this process ensures the development of power sources to produce electrical energy in areas of the world where non-technical barriers deprive energy equity. It is essentially a safety protocol for unsanctioned nuclear reactors.

Reactor weight fully fueled: 1315 lbs - 596 kg.

Sartorium Reactor Encasement Weight Empty: 100 pounds - 36 kilos.

Total Weight of Fluoride Molten Fuel: 220 lbs - 100 kg

Start-up Fuel Mix:

- Fissile part, HALEU, U-235 enriched to 20 percent (425 lbs - 193 kg)
- Non-fissile, Thorium blanket, Th-232, (170 pounds - 77 kg)
- fluoride/salts (400 lbs - 180 kg)

Reactor Breeding Ratio: U-233 breeding ratio of 1:2 allows the reactor to run completely on thorium (burning the breed U-233 in real time) six months after start-up, diminishing the volume of starter fuel required and improving fuel efficiency.

Proliferation Proof: If the reactor is stopped before the HALEU starter fuel is used up (six months), the fuel inside the reactor will be contaminated with U-232 from the start date and thus incapable of fissioning fast enough to become a weapon. After six months, all the U-233 breeded from thorium stock will be used in the fission reaction in real-time.

Accident Proof: In the event of a natural disaster or a complete loss of electricity, the 900 C degree fuel will melt a frozen plug below the reactor, and the molten fuel will passively flow into a graphite-lined Sartorium dump tank. The reaction will stop immediately. The fuel will cool naturally over a 72-hour period. The fuel in the dump tank will be proliferation-proof.

Auto Pilot (Self-Regulating Reactivity): When the demand on the reactor is high, heat is removed faster. As the fuel/coolant loses heat, the molecules get closer together, increasing the number of fissions, thus speeding up the reactor (positive reactivity). When the demand on the reactor ebbs, the fuel/coolant grows hotter, and the molecules get farther apart, decreasing the number of fissions (referred to as creating a void), and thus slowing down the reactor (negative reactivity). Nearly 99 percent of the time, *Walking Leaf* achieves zero reactivity, meaning it is operating at the same speed. It adjusts to variations in power demand within milliseconds.

Electrical Generation: The second loop outside the reactor is helium gas, powering a Closed Brayton Cycle (CBC) with a 60-percent efficiency rating. The helium CBC allows for function in arid and remote locations. The *Walking Leaf* heat exchanger, turbine, and various generators are made of Sartorium, and each is the approximate size of a standard refrigerator freezer. They are bulletproof, closed systems that can also be installed within the encasement basement, or any standard turbine and generator can be easily adapted from *Walking Leaf*'s heat exchanger.

Process Heat: From heat exchanger to facilitate desalination, red hydrogen production, aluminum fabrication, facility heating, and recycling applications.

Integrated Chemical System: Internally recycles fertile salt every 10 days. Harvests radioactive isotopes once per year for medical use.

Camouflage: Presents as a small water tank of the type used in rural Central America, India, Africa, and parts of Indonesia. Rectenna transmitters, relays, and receivers appear as large solar panels.

Small Water Tank Tower Appearance:

- Tank dimensions: 5 feet in diameter, 4 feet high (2 meters, 1.5 meters)
- Gallon capacity: 264 gallons (1000 liters)

- The tank rests on four legs, 6-foot in height, with a 1-foot diameter center support and gravity out flow stem.
- It has the recognizable, double ellipsoidal shape common to many water tanks around the world.
- From the top of the tank to ground level is 8 feet (2.4 meters).

Four Large Solar Panels: Placed above the tank and in each direction of the compass.

Tele-Energy, Atmospheric Electrical Transmission (Wireless): Rectifying antennas (transmitters, relays & receivers). Delivers to existing grid nodes or directly to the user.

Basement Encasement for Reactor: 45 feet long by 25 feet wide by 20 feet deep (13.7 m X 7.6 m X 6m). Required for all *Walking Leaf* reactors operated and maintained exclusively by Artificial Intelligence (AI)..

Artificial Intelligence (A/I): Systems control. Operation. Proliferation prevention. Safety.

Mobility: Fits on two hand-manipulated hydraulic safe dollies with phenolic rollers

Time to refuel: 25 years

Estimated Costs: $10 million US for the *Walking Leaf* reactor and heat exchanger, $250,000 to $500,000 for annual operation.